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Appendix 4 to Amendment C
Claims, Clean Version with No Markings and Showing Changes Incorporated

Commissioner for Patents
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Pursuant to Rule 121, the following is a clean copy of the Pending Claims as amended by the attached Amendment C with all changes incorporated:

Claims

What is claimed is:

27.An internal combustion engine machine incorporating significant improvements in power, efficiency and emissions control comprising:

(a) one or more cylinders, each comprising at least one head, combustion chamber, base, compression chamber and sidewall;

(b) one or more means of igniting fuel in the cylinder(s);

(c) one or more sources of intake air;

(d) at least one means of storing and/or cooling lubricating oil between cycles of circulation;

(e) a drive train;

(f) at least one means of encasing, protecting, cooling and lubricating the drive train;

(g) at least one means of segregating the oil in the sump and/or crankcase from the air or air/fuel mixture in the cylinder, whether within or apart from the combustion chamber.

(h) at least one means of dispersing oil on the cylinder walls and of then gathering excess for return to the oil sump;

(i) at least one means of transmitting energy to and from the pistons;

(j) at least one means of guiding each piston rod such that it moves in a linear manner, always along substantially the same line;

(k) at least one means of drawing air or air/fuel mixture into the engine machine, propelling it into the cylinder combustion chamber, compressing it for ignition and propelling its expulsion after ignition;

(l) at least one means of admitting air and fuel, or air/fuel mixture into each cylinder apart from the combustion chamber;

(m) at least one means of efficiently expelling exhaust gases resulting from combustion of the air fuel mixture after energy has been extracted;

(n) at least one means of transmitting energy from the piston rod to the drive train;

(o) at least one means of cooling the engine; and

(p) at least one means of transporting dispersing gathering and returning lubricating/cooling oil while keeping it segregated from combustion air and fuel;

(q) wherein the means of efficiently expelling exhaust gases upon completion of combustion and energy extraction comprises a cylinder head exhaust valve, allowing exhaust to exit through the head of the cylinder.

28. An internal combustion engine machine incorporating significant improvements in power, efficiency and emissions control comprising:

(a) one or more cylinders, each comprising a head, a combustion chamber, a base, a compression chamber and a sidewall;

(b) one or more means of igniting fuel in the cylinder(s);

(c) one or more sources of intake air;

(d) at least one means of storing and/or cooling lubricating oil between cycles of circulation;

(e) a drive train;

(f) at least one means of encasing, protecting, cooling and lubricating the drive train;

(g) at least one means of segregating the oil in the sump and/or crankcase from the air or air/fuel mixture in the cylinder, whether within or apart from the combustion chamber.

(h) at least one means of dispersing oil on the cylinder walls and of then gathering excess for return to the oil sump;

(i) at least one means of transmitting energy to and from the pistons;

(j) at least one means of guiding each piston rod such that it moves in a linear manner, always along substantially the same line;

(k) at least one means of drawing air or air/fuel mixture into the engine machine, propelling it into the cylinder combustion chamber, compressing it for ignition and propelling its expulsion after ignition;

(l) at least one means of admitting air and fuel, or air/fuel mixture into each cylinder apart from the combustion chamber;

(m) at least one means of efficiently expelling exhaust gases resulting from combustion of the air fuel mixture after energy has been extracted;

(n) at least one means of transmitting energy from the piston rod to the drive train;

(o) at least one means of cooling the engine;

(p) at least one means of transporting, dispersing, gathering, and returning lubricating/cooling oil while keeping it segregated from combustion air and fuel; and

(q) at least one means of collecting, storing, and transferring inertial energy from one drive stroke to another, comprising at least one inertial mass or flywheel.

29. An internal combustion engine machine incorporating significant improvements in power, efficiency and emissions control comprising:

(a) one or more cylinders, each comprising at least one head, combustion chamber, base, compression chamber and sidewall;

(b) one or more means of igniting fuel in the cylinder(s);

(c) one or more sources of intake air;

(d) at least one means of transporting dispersing gathering and returning lubricating and ,or, or, cooling oil;

(e) at least one means of storing and/or cooling lubricating oil between cycles of circulation;

(f) at least one means of dispersing lubricating oil on the cylinder walls and of then gathering excess for return to an oil sump;

(g) at least one means of segregating lubricating oil from the combustion air or air/fuel mixture, and combustion products at substantially all points in the engine.

(h) at least one drive train;

(I) at least one means of, protecting, cooling and, or, or, lubricating the drive train;

(j) at least one means of transmitting energy to and from the pistons;

(k) at least one means of guiding each piston rod such that it moves in a linear manner, always along substantially the same line;

(l) at least one means of drawing air or air/fuel mixture into the engine machine, of propelling it into the cylinder combustion chamber, of compressing it for ignition, and of propelling its expulsion after ignition;

(m) at least one means of admitting air, fuel, or an air/fuel mixture into each cylinder; apart from the combustion chamber.

(n) at least one means of expelling exhaust gases resulting from combustion of the air fuel mixture after energy has been extracted;

(o) at least one means of transmitting energy from the piston rod to the drive train;

(p) at least one means of cooling the engine; and

(q) at least one means of expelling exhaust gases upon completion of combustion and energy extraction comprising at least one cylinder head exhaust valve, allowing exhaust to exit through the head of the cylinder.

30. An internal combustion engine machine as in claim 27 comprising at least one plurality of cylinders in one or more banks of two opposing cylinders each.

31. An internal combustion engine machine as in claim 27 wherein the means of transmitting energy to and from the each piston comprises;

(a) at least one piston-rod with a piston attached at one end;

(b) each piston rod passing through the base of its cylinder, carrying the force of its associated piston power stroke to the drive train;

(c) the piston rod linked to the drive shaft by at least one push rod in the crankcase/oil sump, propelling at least one transmission mechanism, comprising at least one crank-plate, or other rotary, or linier device powering at least one drive shaft.

32. An internal combustions engine machine as in claim 27 wherein the means of cooling the engine comprises exhaust gas expansion, cooling fins and at least one volume of oil circulated through the cylinders and pooled in the sump, the sump acting as at least one heat sink for oil circulating from the cylinders.

33. An internal combustion engine machine as in claim 27 wherein the means of transmitting energy from the piston rod to the drive train comprises at least one rotary device, linked to the piston rod by at least one push rod.

34. An internal combustion engine machine in claim 27 in which the means of transmitting energy from the piston rod to the drive train comprises at least one rack and pinion transmission system, segmented gear drive, or ratchet device.

35. An internal combustion engine machine as in claim 27 wherein the means of admitting the fuel component of the air/fuel mixture into each cylinder comprises at least one fuel injector for each cylinder.

36. An internal combustion engine machine as in claim 27 wherein the means of admitting air or air/fuel mixture into each cylinder obtained by intake ports in the sidewall of each cylinder.

37. An internal combustion engine machine as in claim 27 wherein the means of efficiently expelling exhaust gases upon completion of combustion and energy

extraction comprises at least one cylinder head exhaust valve, allowing exhaust to exit through the head of the cylinder.

38. An internal combustion engine machine as in claim 27 wherein a means of drawing air or air/fuel mixture into the system, propelling it into the cylinder combustion chamber, compressing it for ignition and expelling it after ignition comprises at least one multi-function piston, that:

(a) on upstroke, draws air from an intake source and into an intake/compression chamber beneath the piston, at the same time, compressing an air/fuel mixture in the cylinder combustion chamber above the piston, and then,

(b) on down stroke, following combustion of the air/fuel mixture, compresses and propels scavenge air out of the intake/compression chamber below the piston, and into the cylinder combustion chamber above the piston, then,

(c) on the following up-stroke, expels the scavenge air and remaining exhaust from the combustion chamber, at the same time drawing combustion air or a combustion air/fuel mixture into an intake/compression chamber below the piston, then,

(d) on the following down stroke; compresses and propels the combustion air or air/fuel mixture, out of the intake/compression chamber below the piston, and into the cylinder combustion chamber above the piston, for combustion, completing a cycle.

39. An internal combustion engine machine as in claim 27 wherein a means of drawing air or air/fuel mixture into the system, propelling it into the cylinder combustion chamber, compressing it for ignition and expelling it after ignition comprises a two stroke process wherein at least one multi-function piston:

(a) on a single up stroke, draws combustion air or air/fuel mixture from the intake source and into an intake/compression chamber beneath the piston, and compresses the air or air/fuel mixture in the combustion chamber, then,

(b) upon combustion, on a single down stroke, propels combustion air or air fuel mixture out of the compression chamber into a cylinder combustion chamber above the piston, at the same time expelling the exhaust from the combustion chamber and completing the combustion/exhaust cycle.

40. An internal combustion engine machine as in claim 27 wherein the means of guiding each piston rod such that it moves in a linear manner, always along substantially the same line, comprises at least one compression wall and at least one piston rod compression seal, the compression seal serving as a piston rod guide to hold each piston in correct position within its cylinder.

41. An internal combustion engine machine as in claim 27 wherein there is provided for each cylinder, at least one multi-function piston performing in four strokes, intake, compression, combustion, exhaust and power functions plus lubrication, these comprising, to:

(a) draw in new combustion air or air/fuel mixture into an intake/compression chamber, separate from the cylinder combustion chamber,

(b) compress and propel the new air or air/fuel mixture from the intake/compression chamber, into the cylinder combustion chamber,

(c) compress the air/fuel mixture in the cylinder combustion chamber,

(d) draw in scavenge air into an intake/compression chamber, separate from the cylinder combustion chamber,

(e) receive the force of combustion for transmission to the piston rod,

(f) compress and propel the scavenge air from the intake/compression chamber, into the cylinder combustion chamber,

(g) compress and propel the scavenge air and combustion by-products from the cylinder combustion chamber as exhaust, and

(h) receive, disperse and recoup lubricating oil for return to the oil sump/cooler.

42. An internal combustion engine machine as in claim 27 wherein there is provided for each cylinder, at least one multi-function piston performing, in two strokes, intake,

compression, combustion, exhaust and power functions plus lubrication, these comprising, to:

(a) in a single upstroke, draw new combustion air or air/fuel mixture into an intake/compression chamber, separate from a cylinder combustion chamber, and in the same action, compress an air/fuel mixture in the cylinder combustion chamber,

(b) receive the force of combustion for transmission to the piston rod,

(c) in a single down-stroke, upon combustion in the cylinder combustion chamber, compress and propel the new air or air/fuel mixture from the intake/compression chamber, into the cylinder combustion chamber, and in the same action, scavenge and exhaust combustion by-products from the cylinder combustion chamber, and,

(d) receive, disperse and recoup lubricating oil for return to the oil sump/cooler.

43. An internal combustion engine machine as in claim 27 wherein the means of dispersing oil on the cylinder walls and of then gathering excess for return to the oil sump comprises oil hoarding rings, at least one ring located near the head and base of at least one piston, such that the rings contain any oil dispersed between them, and when in motion, push said oil before them, substantially wiping it off the cylinder walls as they move.

44. An internal combustion engine machine as in claim 27 wherein a means of segregating the oil in the sump and/or crank case from the air or air/fuel mixture in the cylinder comprises at least one compression wall and piston rod pressure seal at the base of at least one cylinder;

(a) the compression wall segregating the fuel, air, or combustion by-products in at least one cylinder from the lubricating, and, or, or, oil in the oil sump/crankcase, thus creating at least one segregated and sealed intake chamber into which the air or fuel/air mixture is first received from the carburetor, breather, or other combustion air source, and from which it is discharged into the cylinder combustion chamber; and

(b) a piston rod passing through the compression wall at the base of each corresponding cylinder and into the sump/crankcase by way of the compression wall and pressure seal.

45. An internal combustion engine machine as in claim 27 wherein a means of encasing, protecting, and lubricating the drive train comprises at least one combination crankcase, and, or, or, oil sump;

46. (previously amended) An internal combustion engine machine as in claim 27 wherein a means of storing and/or cooling the oil between cycles of circulation comprises at least one combination crankcase/oil sump;

47. An internal combustion engine machine as in claim 27 wherein a source of intake air comprises at least one carburetor;

48. An internal combustion engine machine as in claim 27 wherein a means of igniting the fuel comprises an electrical spark;

49. An internal combustion engine machine as in claim 27, wherein a means of transporting, dispersing, gathering and returning lubricating, and, or, or, cooling oil while keeping it segregated from combustion air and fuel comprises;

(a) at least one dynamic force lubricating oil pump comprising at least one piston rod/lubrication assembly that serves as both at least one means of transmitting force to and from the piston and as at least one means to transmit lubricating/cooling oil to as associated cylinder via at least one multi-function piston assembly;

(b) at least one multi-function-piston assembly comprising at least one piston rod with at least one multi-function piston attached to either or each end, and having one or more oil pick-up and exhaust ports in its mid section, and one or more oil transport passages in the piston rod from the oil pick-up nozzles to the multi-function-piston and back to the oil exhaust ports;

(c) each multi-function-piston comprising one or more radially situated oil inlet and outlet ports that distribute lubricating oil to the associated

cylinder and recover the oil for return to the sump/crankcase, and each multi-function piston also comprising;

(d) at least one oil hoarding ring near each piston head and base to assist in dispersing and then re-gathering the oil for return to a sump such that oil flows through the piston rod and piston, and around the piston, lubricating and cooling piston walls, piston rings and cylinder walls, and returns through the piston and piston rod to the oil sump.

50. An internal combustion engine machine as in claim 27 wherein at least one wrist pin links each piston to its piston rod.

51. An internal combustion engine machine as in claim 27 wherein a means of igniting fuel in the cylinders comprises explosive compression in the cylinder head.

52. An internal combustion engine machine as in claim 27 wherein a means of igniting fuel in the cylinders comprises at least one glow plug.

53. (previously amended) An internal combustion engine machine as in claim 27 wherein a means of igniting fuel in the cylinders comprises at least one electrical spark.

54. An internal combustion engine machine as in claim 28 wherein a means of transmitting energy to and from the pistons comprises at least one piston-rod between

and joining each pair of pistons in each cylinder bank such that each piston rod has a piston at each end,

(a) each piston rod passing through the base of its associated cylinder, each piston rod carrying the force of its associated piston power stroke to the drive train, and across to the opposite associated piston, thereby, powering that piston's compression stroke, and

(b) at least one piston rod linked, directly or indirectly, to a drive shaft, via at least one rotary or linier energy transmission device.

55. An internal combustion engine machine as in claim 28 comprising at least one plurality of banks of cylinders, each bank comprised of two or more cylinders and the drive train of each bank joined to the drive train of its neighboring bank(s) in such a way that each bank may be independently disconnected from its neighbor(s) and shut down automatically or at the discretion of the operator, the manner of joining the bank drive trains being, in example, manual clutch(es), centrifugal clutch(es), or ratchet devices.

56. An internal combustion engine machine incorporating significant improvements in power, efficiency and emissions control comprising;

(a) one or more cylinders, each comprising at least one head, combustion chamber, base, compression chamber and sidewall;

(b) one or more means of igniting fuel in the cylinder(s);

(c) one or more sources of intake air;

(d) at least one means of storing and/or cooling lubricating oil between cycles of circulation;

(e) a drive train;

(f) at least one means of encasing, protecting, cooling and lubricating the drive train;

(g) at least one means of segregating the oil in the sump and/or crankcase from the air or air/fuel mixture in the cylinder;

(h) at least one means of dispersing oil on the cylinder walls and of then gathering excess for return to the oil sump;

(i) at least one means of transmitting energy to and from the pistons;

(j) at least one means of guiding each piston rod such that it moves in a linear manner, always along substantially the same line;

(k) at least one means of drawing air or air/fuel mixture into the engine machine, propelling it into the cylinder combustion chamber, compressing it for ignition and propelling its expulsion after ignition;

(l) at least one means of admitting air and fuel, or air/fuel mixture into each cylinder;

(m) at least one means of efficiently expelling exhaust gases resulting from combustion of the air fuel mixture after energy has been extracted;

(n) at least one means of transmitting energy from the piston rod to the drive train;

(o) at least one means of cooling the engine; and

(p) at least one means of transporting, dispersing, gathering, and returning lubricating/cooling oil while keeping it segregated from combustion air and fuel;

(q) wherein, the means of transporting, dispersing, gathering and returning lubricating/cooling oil while keeping it segregated from combustion air and fuel comprises at least one dynamic force lubricating oil pump comprising;

(r) at least one piston rod/lubrication assembly that serves both as at least one means of transmitting force to and from the piston and as at least one means to transmit lubricating/cooling oil to and from its cylinder in concert with at least one multi-function piston;

(s) the piston rod/lubrication assembly comprising at least one piston rod with a multi-function piston attached to each end, oil pick-up nozzles and exhaust ports in its mid section, and oil transport passages in the piston rod from the oil pick-up nozzles to the multi-function piston and back to the oil exhaust ports;

(t) the multi-function piston comprising at least one piston configured with one or more radially situated oil inlet and outlet ports that distribute lubricating oil received from the piston rod/lubrication assembly, to the associated cylinder, and that recover the oil for return to the sump/crankcase via the piston rod/lubrication assembly; and

(u) the multi-function-piston assembly also comprising oil hoarding rings near each piston head and base to assist in dispersing and then re-gathering the oil for return to the cooling, sump such that oil flows through the piston rod and piston, and around the piston, and returns through the piston and piston rod to the oil sump/crank case.

57. An engine machine as in claim 27 wherein the means of admitting air or air/fuel mixture into each cylinder is a "pop-top" piston comprising a valve in the piston head that periodically opens to admit new air or fuel/air mixture for each combustion.

58. An engine machine as in claim 27 wherein the means of admitting the fuel component of the air/fuel mixture into each cylinder is via a fuel injector for each cylinder.